CHAPTER 1

Getting Started

This chapter contains information about safety, system specifications, inspecting the system, preventing electrostatic discharge (ESD) damage, and required tools and parts. For international regulatory compliance information, refer to the appendix “Regulatory Compliance.”

Caution If you plan to place the router on a desk or table, do not place anything on top of the router that weighs in excess of 10 pounds (4.5 kg). Excessive weight on top could damage the chassis.

Safety Recommendations

Follow these guidelines to ensure general safety:

- Keep the work area clear and dust-free during and after installation.
- Put the removed chassis cover in a safe place.
- Keep tools away from walk areas where you and others could fall over them.
- Do not wear loose clothing that could get caught in the chassis. Fasten your tie or scarf and roll up your sleeves.
- Wear safety glasses when working under any conditions that might be hazardous to your eyes.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.

Warning Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

- Locate the emergency power-off switch for the room in which you are working. Then, if an electrical accident occurs, you can act quickly to shut off power.
- Before working on the system, turn off the power and unplug the power cord.
- Disconnect all power before doing the following:
  - Installing or removing a chassis
  - Working near power supplies
  - Performing a software upgrade
- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit. Always check.
- Look carefully for possible hazards in your work area, such as moist floors, ungrounded power extension cables, and missing safety grounds.
- If an electrical accident occurs, proceed as follows:
  - Use caution; do not become a victim yourself. Turn off power to the system.
  - If possible, send another person to get medical aid. Otherwise, assess the condition of the victim and then call for help.
  - Determine if the person needs rescue breathing or external cardiac compressions; then take appropriate action.

System Specifications

Table 1-1 shows the specifications for the product.

Table 1-1 System Specifications

Description	Design Specification
Dimensions H x W x D	1.75"[1] x 17.5" x 10.56" (4.44 cm x 44.45 cm x 26.82 cm)
Weight	10 lb (4.5 kg)
Input voltage, AC Power Supply Frequency Power dissipation	 100 to 240 volts alternating current (VAC) 50 to 60 hertz (Hz) 40W (max.) 135.5 British thermal units (Btus)/hr
Input voltage, DC Power Supply Current Power dissipation	 40W, -40 to -72 volts direct current (VDC) 1.0 to 0.5 (A) 40W (max.), 135.5 British thermal units (Btus)/hr
Processor	20-MHz Motorola 68EC030
Router Network interface options	1 Ethernet and 2 synchronous serial (2501) 1 Token Ring and 2 synchronous serial (2502) 1 Ethernet, 2 synchronous serial, and 1 BRI (2503) 1 Token Ring, 2 synchronous serial, and 1 BRI (2504) 1 Ethernet, 1 Token Ring, 2 synchronous serial (2513) 2 Ethernet, 2 synchronous serial (2514) 2 Token Ring, 2 synchronous serial (2515)
Hub Network interface options	2 synchronous serial, 8 hub (2505) 2 synchronous serial, 16 hub (2507) 2 synchronous serial, 14 hub, 1 BRI (2516)
Access Server Network interface options	1 Ethernet, 2 synchronous serial, 8 asynchronous serial (2509) 1 Token Ring, 2 synchronous serial, 8 asynchronous serial (2510) 1 Ethernet, 2 synchronous serial, 16 asynchronous serial (2511) 1 Token Ring, 2 synchronous serial, 16 asynchronous serial (2512)

Description	Design Specification
Ethernet interface	Attachment unit interface (AUI) IEEE 802.3 (DB-15)
Hub interface	8, 14, or 16 RJ-45 (10BaseT)
Token Ring interface	IEEE 802.5 (DB-9), 8 or 16 RJ-45
Synchronous serial interfaces	EIA/TIA-232[2], EIA/TIA-449, V.35, X.21 (NRZ/NRZI[3] and DTE/DCE[4]) EIA-530 (NRZ/NRZI and DTE) All serial cables use a DB-60 chassis connector.
Asynchronous serial interfaces	EIA/TIA-232, EIA/TIA-449, with hardware flow control support Asynchronous serial interfaces use the breakout cable (RJ-45)
BRI	ISDN Basic Rate S/T (RJ-45) (2503, 2504, and 2516 only)
Console and auxiliary ports	Asynchronous serial (RJ-45)
Operating environment	32 to 104°F (0 to 40°C)
Nonoperating temperature	-40 to 185°F (-40 to 85°C)
Operating humidity	5 to 95%, noncondensing
Noise level	34 dBa @ 3' (0.914 m)
Agency approvals	Safety: UL 1950, CSA 950, EN60950, TUV-GS-mark EMI: FCC Class A, VCE Class B, Canadian DOC Class A, EN55022 Class B (CISPR22 Class B), VCCI Class 2

1. 1.75" = One rack unit.
2. EIA/TIA-232 and EIA/TIA-449 were known as recommended standards RS-232 and RS-449 before their acceptance as standards by the Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA).
3. NRZ = Nonreturn to zero. NRZI = Nonreturn to zero inverted.
4. DTE = Data terminal equipment. DCE = Data communications equipment.

Inspecting the System

Do not unpack the system until you are prepared to install it. If the final installation site is not ready, keep the chassis in the shipping container to prevent accidental damage. When you have determined where you want the router installed, proceed with the unpacking. Check the packing list to ensure that you received the following items:

- Router
- 6-foot (1.8-meter) power cord
- Rubber feet for desktop installation
- Ethernet jackscrews (model 2501 and 2503)
- Console cable (RJ-45) with RJ-45-to-DB-25 and RJ-45-to-DB-9 adapters
- Warranty package
- Optional equipment (network connection cables, auxiliary cable, and so forth)
- Optional UniverCD or printed companion publications as specified by your order

Inspect all items for shipping damage. If anything appears damaged, contact a customer service representative.

Note To order UniverCD, Cisco's library of product information in CD-ROM format, or printed documentation, refer to *Ordering Cisco Documentation*, which is in your warranty package.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry. It occurs when electronic components are improperly handled and can result in complete or intermittent failures. Always follow ESD-prevention procedures when removing and replacing components. Ensure that the chassis is electrically connected to earth ground. Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to an unpainted chassis frame surface to safely channel unwanted ESD voltages to

ground. To properly guard against ESD damage and shocks, the wrist strap and cord must operate effectively. If no wrist strap is available, ground yourself by touching the metal part of the chassis.

Caution For safety, periodically check the resistance value of the antistatic strap, which should be within the range of 1 and 10 megohm.

Tools and Parts Required

Following are the tools and parts required to install the router:

- Small, 3/16-inch (0.476 cm), and medium, 1/4-inch (0.625 cm), flat-blade screwdrivers
- ESD-preventive wrist strap
- Rubber feet for desktop installation
- Rack-mount brackets for rack- or wall-mount installation (screws not included)
- One interface cable for each interface you require

In addition, you might need the following external equipment:

- Channel service unit/digital service unit (CSU/DSU) for the serial interfaces
- Ethernet transceiver (models 2501, 2503, 2509, 2511, 2513, and 2514)
- Token Ring media attachment unit (MAU) (models 2502, 2504, 2510, 2512, 2513, and 2515)
- For the Basic Rate Interface (BRI)—Access to an Integrated Services Digital Network (ISDN) through the NT1

  The common carrier will provide the NT1 connection worldwide, except in North America, where the NT1 is customer owned.
- Modem for remote configuration (if required)
- Modem for remote network access on access servers
- Console terminal (configured for 9600 baud, 8 data bits, no parity, and 2 stop bits) if future reconfiguration is expected

CHAPTER 2

Installing the Hardware

Follow these steps to install, configure, and connect your router:

Step 1 Install the router hardware using the procedures described in this chapter. Refer to the appendix "Regulatory Compliance" if you are installing the router in the United Kingdom, Europe, or Italy.

Step 2 After installing the hardware, refer to the appropriate software publication to configure the router.

Note All Cisco technical documentation is available on UniverCD, Cisco's online library of product information. UniverCD is updated monthly, so it is sometimes more up to date than printed documentation. UniverCD is available both as a single CD-ROM or as an annual subscription. To order UniverCD, call Customer Service.

Step 3 See the "Preparing for External Connections" section in this chapter for cabling instructions. If necessary, see the "Reference" chapter for basic troubleshooting, Flash memory, and cable-pinout information.

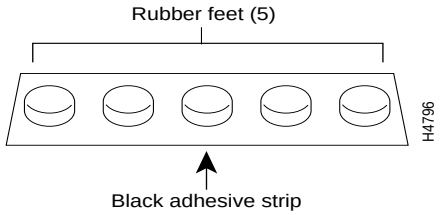
Installing the Rubber Feet

This section explains how to install the rubber feet on the bottom of the chassis. If you want to rack-mount the chassis, skip this section and proceed with the next section, "Rack-Mounting the Chassis." If you want to wall-mount the chassis, skip this section and proceed with the section "Wall-Mounting the Chassis" later in this chapter.

Before placing the router on a desktop, shelf, or other flat, secure surface, perform the following steps to install the rubber feet:

Step 1 Locate the rubber feet on the black adhesive strip that shipped with the chassis. (See Figure 2-1.)

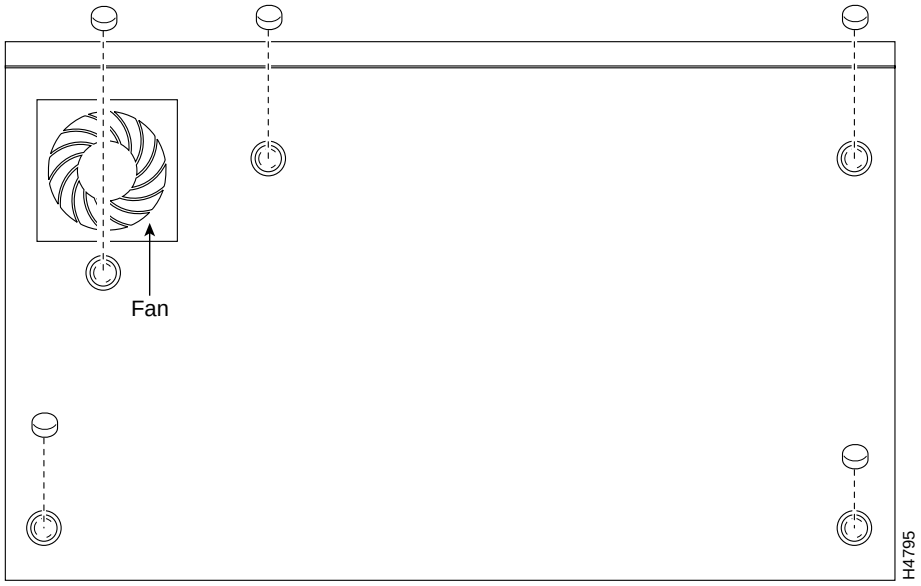
Figure 2-1 Identifying the Rubber Feet



Step 2 Place the router upside down on a smooth, flat surface.

Step 3 Peel off one of the rubber feet from the black adhesive strip and place it adhesive-side down onto one of the five round recessed areas on the back of the chassis, as shown in Figure 2-2. Repeat this step to install the remaining four feet.

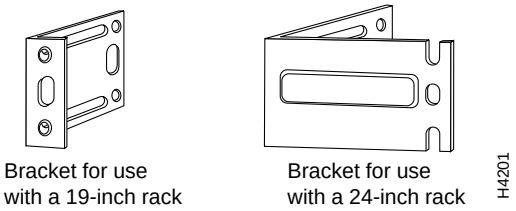
Figure 2-2 Installing the Rubber Feet



Rack-Mounting the Chassis

This section describes the procedures for rack-mounting the chassis. Your chassis ships with a bracket for use with a 19-inch rack or, if specified in your order, an optional, larger bracket for use with a 24-inch rack. The brackets are shown in Figure 2-3.

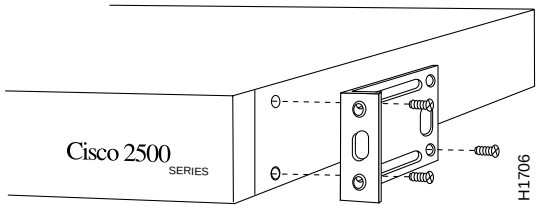
Figure 2-3 Identifying the Brackets



Attaching the Brackets

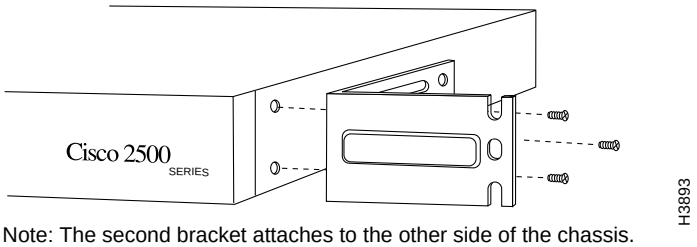
To install the chassis in a rack with the front panel forward, attach the brackets as shown in Figure 2-4 or Figure 2-5.

Figure 2-4 19-Inch Rack Installation—Front Panel Forward



Note: The second bracket attaches to the other side of the chassis.

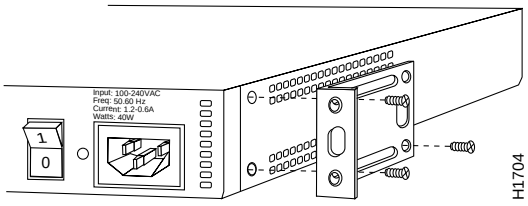
Figure 2-5 24-Inch Rack Installation—Front Panel Forward



Note: The second bracket attaches to the other side of the chassis.

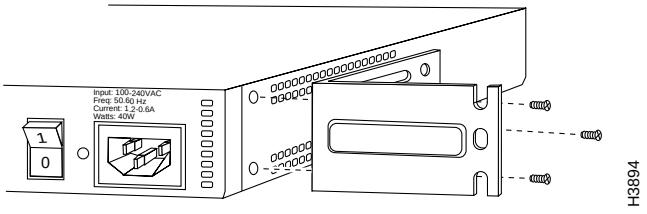
To install the chassis in a rack with the rear panel forward, attach the brackets as shown in Figure 2-6 or Figure 2-7.

Figure 2-6 19-Inch Rack Installation—Rear Panel Forward



Note: The second bracket attaches to the other side of the chassis.

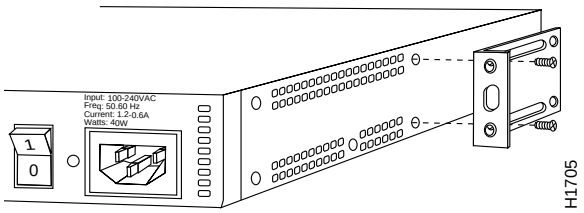
Figure 2-7 24-Inch Rack Installation—Rear Panel Forward



Note: The second bracket attaches to the other side of the chassis.

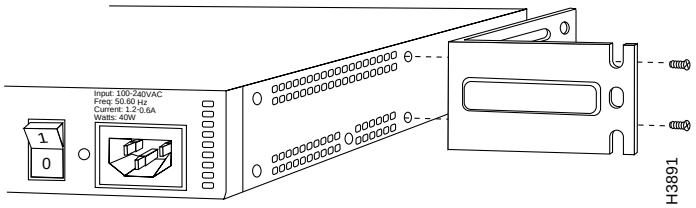
To install the chassis in a center-mount telco rack, attach the brackets as shown in Figure 2-8 or Figure 2-9.

Figure 2-8 Telco 19-Inch Rack Installation—Rear Panel Forward



ote: The second bracket attaches to the other side of the chassis.
The brackets can also be installed with the front panel forward.

Figure 2-9 Telco 24-Inch Rack Installation—Rear Panel Forward

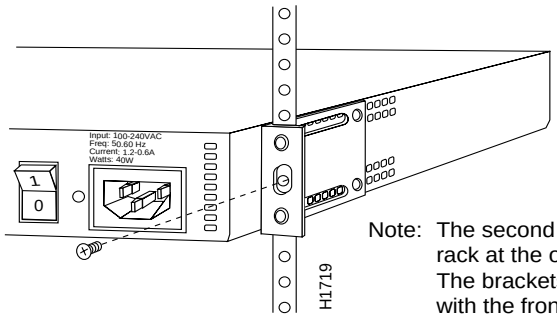


Note: The second bracket attaches to the other side of the chassis.
The brackets can also be installed with the front panel forward.

Installing in a Rack

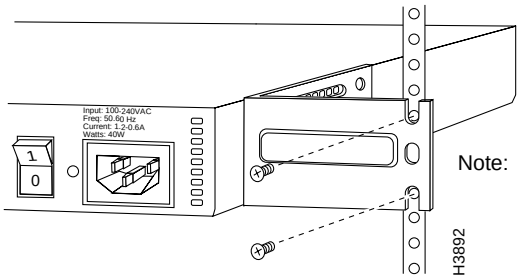
After the brackets are secured to the chassis, you can rack-mount the chassis. Using the screws you provide, attach the chassis to the rack as shown in Figure 2-10 or Figure 2-11.

Figure 2-10 Attaching the Chassis to the 19-Inch Rack—Rear Panel Forward



Note: The second bracket attaches to the rack at the other side of the chassis. The brackets can also be installed with the front panel forward.

Figure 2-11 Attaching the Chassis to the 24-Inch Rack—Rear Panel Forward



Note: The second bracket attaches to the rack at the other side of the chassis. The brackets can also be installed with the front panel forward.

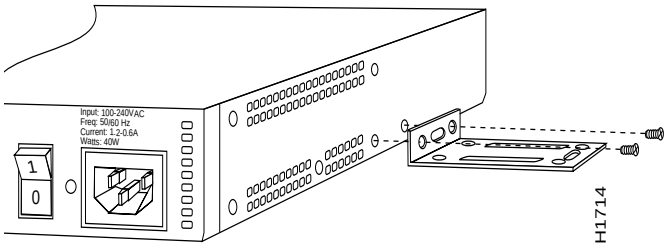
Caution If you plan to place the router on a desk or table, do not place anything on top of the router that weighs in excess of 10 pounds (4.5 kg). Excessive weight on top could damage the chassis.

Wall-Mounting the Chassis

Use the smaller brackets, for use with a 19-inch rack, to wall-mount chassis. The smaller brackets will provide the most stable position for the chassis. To wall-mount the chassis, follow these steps:

Step 1 Attach the brackets as shown in Figure 2-12.

Figure 2-12 Attaching the Wall-Mount Brackets

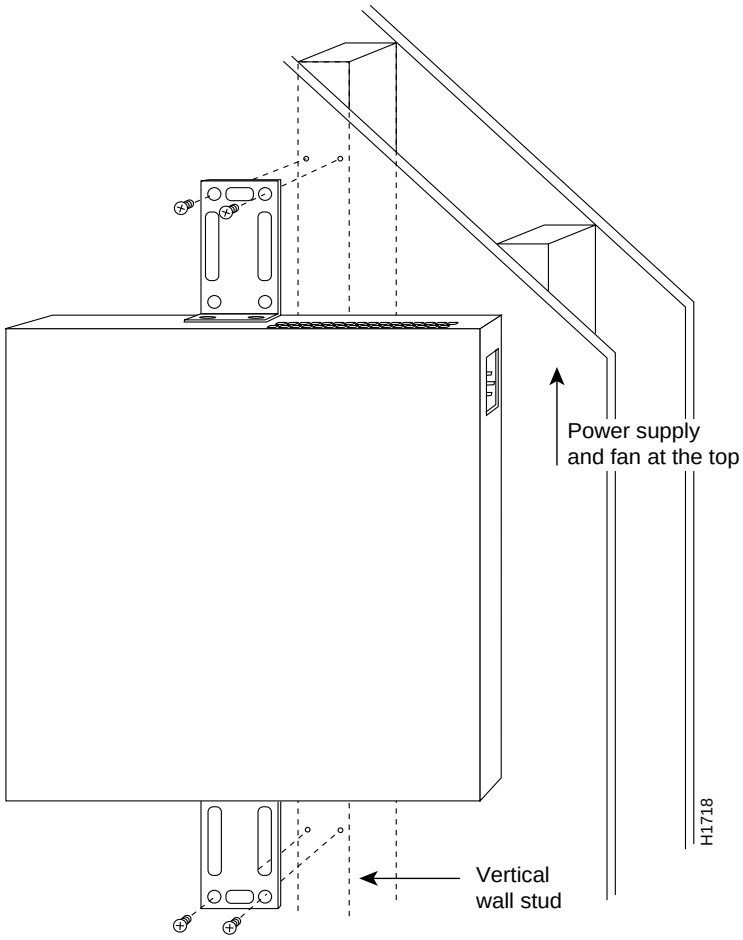


Step 2 Attach the chassis assembly to the wall as shown in Figure 2-13, using screws and anchors that you provide. We recommend the following:

- For the best support of the chassis and cables, attach the brackets so that the screws align with a vertical wall stud.
- For the best ventilation of the chassis, mount the chassis with the power supply and fan at the top.

Caution To prevent the chassis from pulling away from the wall when cables are attached, align the brackets and screws with a vertical wall stud. (See Figure 2-13.) To ensure adequate ventilation, make sure there is clearance between the router and the wall. Mount the router as shown in Figure 2-13, placing the chassis fan and power supply at the top.

Figure 2-13 Wall-Mounting the Chassis



Preparing for External Connections

Following are the procedures for making external connections to the different router, access server, and hub models.

Connections for Router Models

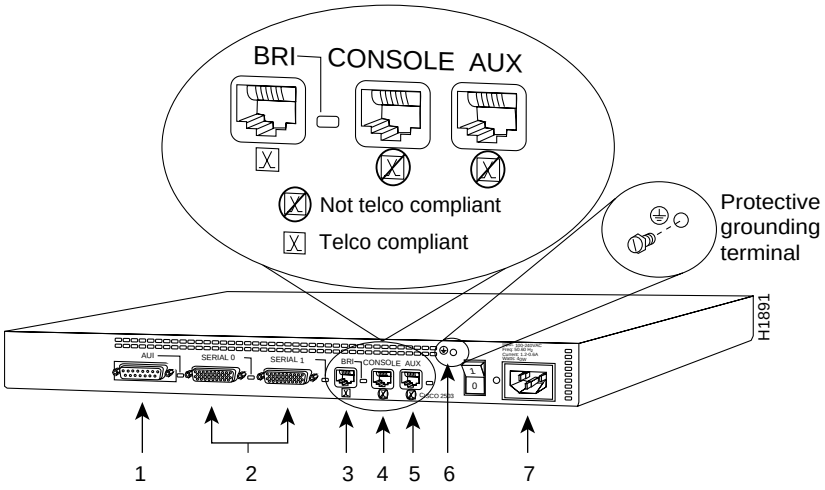
Figure 2-14 shows the rear panel of the single LAN router (the rear panel of the dual LAN router is similar), with the following connectors:

1. Ethernet DB-15 (models 2501, 2503 [2503 shown], 2513, and 2514)
   or Token Ring DB-9 (models 2502, 2504 [2502 shown], 2513, and 2515)
2. Serial DB-60 (2 connectors—all models)
3. BRI RJ-45 (models 2503, 2504, and 2516)

Caution To prevent damage to the system, connect the BRI cable to the BRI interface *only* and not to any other RJ-45 connector. The console, auxiliary, and BRI ports all use RJ-45 connectors.

4. Console RJ-45
5. Auxiliary RJ-45
6. Protective grounding terminal (requires an M 3.5 thread-forming screw that is not included)
7. AC power input

Figure 2-14 Model 2503 Rear Panel



Connections for Hub Models

Figure 2-15 shows an example of the rear panel of a hub. This hub has 14 ports and the following connectors:

1 One or two banks of Ethernet RJ-45

2 MDI/MDI-X switch

3 One BRI port

4 Synchronous serial DB-60 (2 connectors—all models)

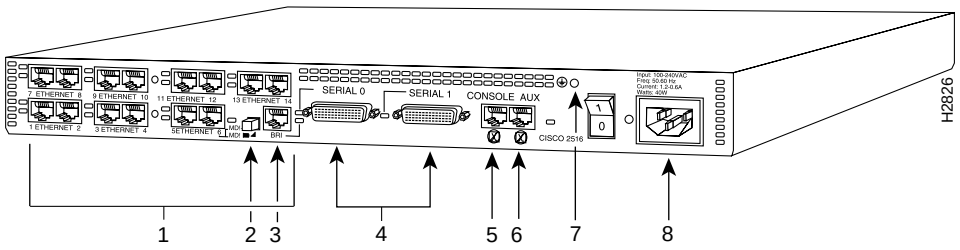
5 Console RJ-45

6 Auxiliary RJ-45

7 Protective grounding terminal (requires an M 3.5 thread-forming screw that is not included)

8 AC power input

Figure 2-15 Hub (Model 2516) Rear Panel



Connections for Access Server Models

Figure 2-16 shows the rear panel of an access server with 16 ports and the following connectors:

1 One or two 68-pin SCSI ports

2 Ethernet DB-15 or Token Ring DB-9 (models 2510 and 2512 not shown)

3 Synchronous serial DB-60 (2 connectors)

4 Console RJ-45

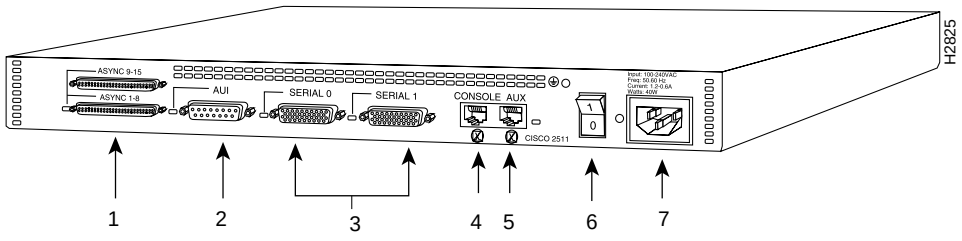
5 Auxiliary RJ-45

6 Protective grounding terminal (requires an M 3.5 thread-forming screw that is not included)

7 AC power input

Note If you are installing a model 2501, 2503, 2509, 2511, 2513, or 2514 *and* your Ethernet connection requires jackscrews, remove the slide-latch assembly from the AUI connector and attach the jackscrews provided.

Figure 2-16 Access Server (Model 2511) Rear Panel



Making External Connections

Following is the procedure for connecting external cables to the router. If your router has an Ethernet port, begin at Step 1. If it has a Token Ring port, begin at Step 3. If it is a hub model, begin at Step 4.

Step 1 Connect the Ethernet port to a transceiver as shown in Figure 2-17. If necessary, extend the Ethernet cable as shown in Figure 2-18.

If your router has a Token Ring port, proceed to Step 3. If your router does not have a Token Ring port or if you are connecting a hub model, proceed to Step 4.

Step 2 If necessary, extend the Ethernet cable as shown in Figure 2-18. Otherwise, proceed to Step 3 if your router has a Token Ring port, or to Step 4 if your router does not have a Token Ring port or you are connecting a hub model.

Figure 2-17 Ethernet Cable Connections

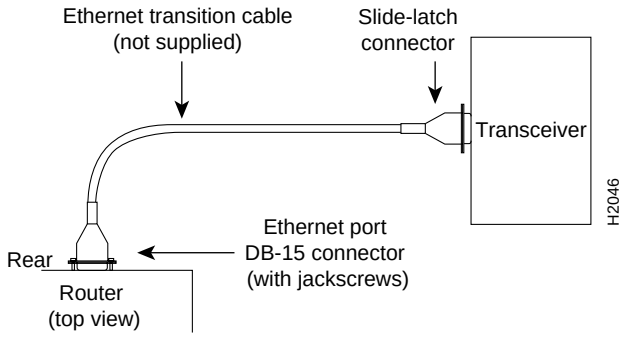
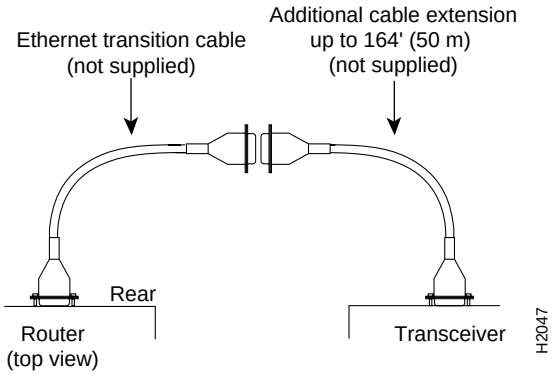
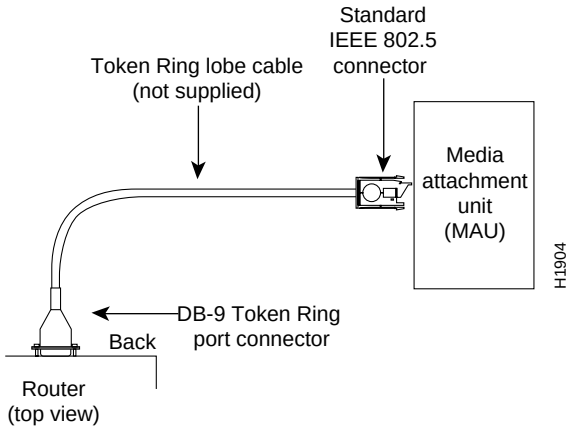


Figure 2-18 Extending the Cable from the Ethernet Port



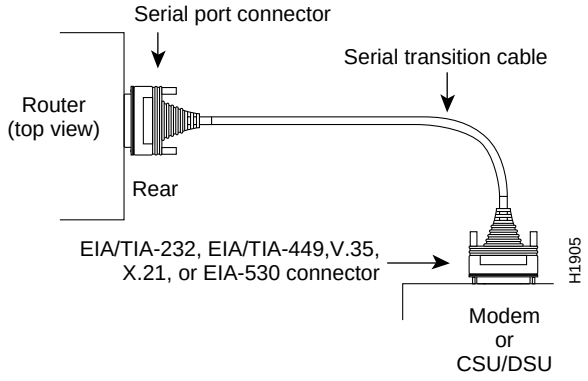
Step 3 Connect the Token Ring port to an MAU as shown in Figure 2-19.

Figure 2-19 Token Ring Cable Connections



Step 4 Connect the serial ports to the modem or CSU/DSU as shown in Figure 2-20. Make certain to connect the 60-pin serial port connector as shown.

Figure 2-20 Serial Cable Connections and DB-60 Connections



Step 5 On hub models, connect RJ-45 cables from the Ethernet ports to your external Ethernet devices. If you have a router model go to Step 7, and if you have a access server, omit this step and continue with Step 6.

Step 6 On access server models, connect modular SCSII-type breakout cables (available from Cisco Systems) to the 68-pin SCSI ports. If you have a 68-pin-to-RJ-45 breakout cable, use RJ-45-to-DB-25 adapters to connect the breakout cable to your serial devices. Or, if you have a 68-pin-to-DB-25 breakout cable, connect the DB-25 connector directly to your serial devices. Refer to the appendix "Cable Pinouts" for more information. Continue with Step 9.

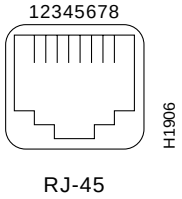
Caution Make sure that the SCSI connector on the breakout cable is securely connected to the SCSI connector on the access server. A short could occur which might damage your access server if the connection is disconnected.

Step 7 The Basic Rate Interface (BRI) port, a female RJ-45 connector on models 2503 and 2504 (see Figure 2-21), is located on the chassis rear panel between the serial 1 and console ports. On the Cisco 2516, the BRI port is located between the serial and Ethernet ports.

On the Cisco 2516, set the MDI/MDI-X switch to MDI-X to configure the hub as a standalone hub. Set the MDI/MDI-X switch to MDI to configure Ethernet port 6 on the hub for connecting to another hub.

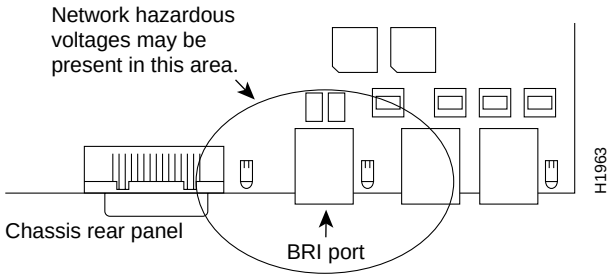
Step 8 Using the appropriate cable, connect the BRI port to the Integrated Services Digital Network (ISDN) through the NT1. The common carrier will provide the NT1 connection worldwide, except in North America, where the NT1 is customer owned.

Figure 2-21 RJ-45 Female Connector—BRI, Console, and Auxiliary Ports



Warning Network hazardous voltages are accessible in the BRI cable. If you detach the BRI cable, detach the end away from the router first to avoid possible electric shock. Network hazardous voltages are also accessible on the system card in the area of the BRI port (RJ-45 connector), regardless of whether power is turned OFF. (See Figure 2-22.)

Figure 2-22 Network Hazardous Voltage Location



Step 9 Connect the asynchronous console and auxiliary ports as required for your method of configuration or if future configuration is expected.

Depending on your terminal or modem connections, the console and auxiliary ports may require an RJ-45-to-DB-25 or RJ-45-to-DB-9 adapter (labeled "Terminal"). Your terminal should be configured for 9600 baud, 8 data bits, no parity, and 2 stop bits.

Caution To prevent damage to the system, make certain you connect the BRI cable to the BRI connector *only* and not to any other RJ-45 connector. The console, auxiliary, BRI, and hub ports all use RJ-45 connectors.

Step 10 Using an M 3.5 thread-forming screw (not included), attach a ground wire to the protective grounding terminal on the chassis rear panel, as required by your installation. (See Figure 2-14.)

Step 11 Connect the power cable between the router and the AC source.

Connecting the DC-Input Power Supply

This section describes the Cisco 2500 series direct current (DC) power supply specifications and wiring. This procedure covers the following information:

- DC Power Specifications
- Wiring the DC-Input Power Supply

Read this entire section before wiring the power supply.

DC Power Specifications

The Cisco 2500 DC-input power supply is intended for use in DC operating environments. Table 2-1 lists the power supply specifications.

Table 2-1 Cisco 2500 DC-Input Power Supply Specifications

Description	Design Specification
Power	40W, -40 to -72 VDC
Wire gauge for power connections	14 AWG[1]

1. AWG—American Wire Gauge

Wiring the DC-Input Power Supply

If you ordered a Cisco 2500 series router with a DC-input power supply, follow the directions in this section for proper wiring. Figure 2-23 shows the rear of the DC-input power supply (Model 2501-DC).

Warning Before conducting any of the following procedures, ensure that power is removed from the DC circuit. To ensure that all power is OFF, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the switch handle of the circuit breaker in the OFF position.

Note The installation must comply with all applicable codes.

Note This product is intended for installation in restricted access areas and is approved for use with copper conductors only.

Figure 2-23 Cisco 2500 Series DC-Input Power Supply—Rear View

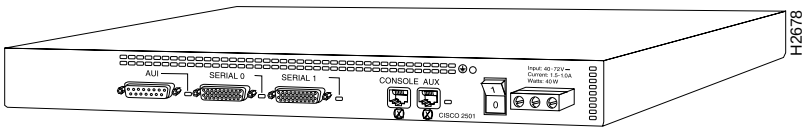


Figure 2-24 shows the Cisco 2500 DC-input power supply terminal block. Follow these procedures for wiring the terminal block.

Step 1 Attach the appropriate lugs at the wire end of the power supply cord.

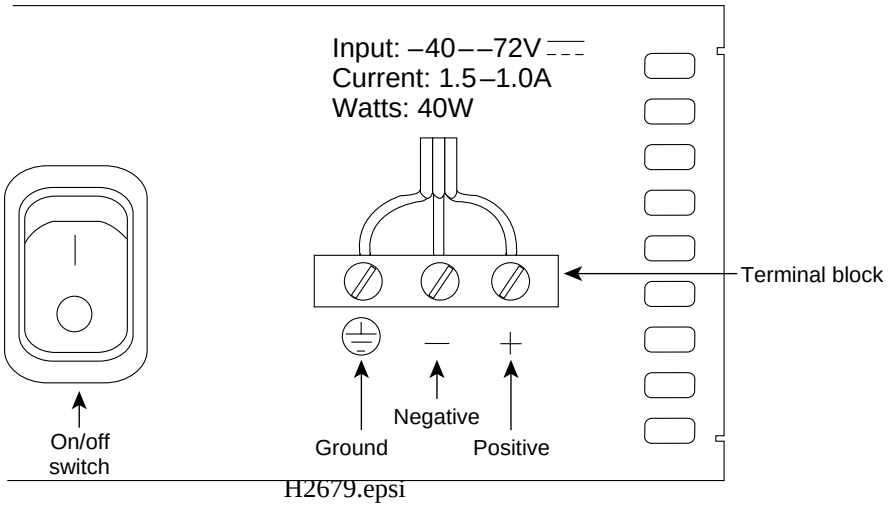
Step 2 Wire the DC-input power supply to the terminal block as shown in Figure 2-24. The proper wiring sequence is ground to ground, positive to positive, and negative to negative.

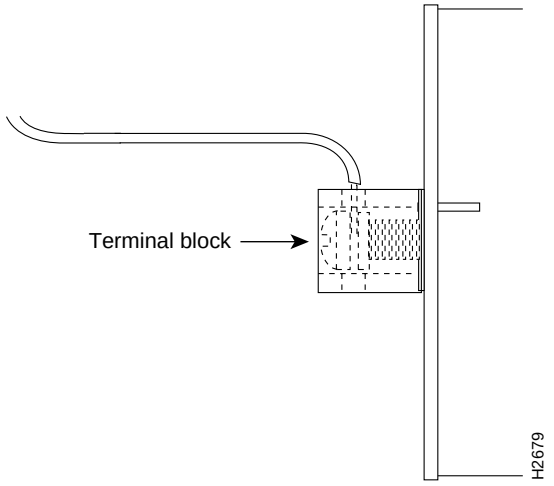
Caution Do not overtorque the terminal block captive thumbscrew or terminal block contact screws. The recommended torque is 8.2 0.4 inch-lb

Caution Secure the wires so that they will not be disturbed by casual contact. For example, secure the wires to a rack frame using tie wraps.

Step 3 Remove the tape from the circuit breaker switch handle and restore power by moving the circuit breaker handle to the ON position.

Figure 2-24 DC-Input Power Supply Connections





What to Do after Installing the Router Hardware

After you install the router hardware, the system is ready to be powered on and configured. For information on router software configuration, refer to the appropriate software publications.

Note To order UniverCD, Cisco's library of product information in CD-ROM format, or printed documentation, refer to *Ordering Cisco Documentation*, which is in your warranty pack.

CHAPTER 3

Reference

This chapter contains information about troubleshooting, enabling booting from Flash memory, copying to Flash memory, and cable pinouts. For additional information about the Cisco 2500 series router hardware, refer to the *Cisco 2500 Series Hardware Installation and Maintenance* publication.

Note The *Cisco 2500 Series Hardware Installation and Maintenance* publication is available on UniverCD or a printed copy can be ordered separately.

Troubleshooting

The key to problem solving in this system is to try to isolate the problem to a specific subsystem. By comparing what the system is doing to what it should be doing, the task of isolating a problem is greatly simplified.

Troubleshooting might require copying or reloading the operating system image from Flash memory or testing cables. Flash memory and cable information is included in this chapter.

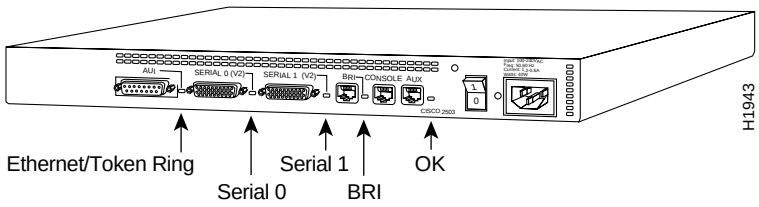
Check the following items to help isolate the problem:

- With the power switch and OK LED ON (see Figure 3-1), does the fan operate? If no, suspect the fan or the 12-volt (V) power supply.
- Does the system not boot up, but the OK LED is ON? Suspect the 12V power supply.
- Does the system partially boot, but the OK LED is not ON? Suspect a 5V power supply failure.

- Does the system shut down after being ON a short time?
  - Suspect a thermal-induced shutdown.
  - Ensure that the chassis intake and exhaust vents are clear.
  - Suspect a power supply failure.

The green OK LED (to the right of the AUX port) should be ON after the system initializes correctly. (See Figure 3-1.)

Figure 3-1 Router LEDs—Rear-Panel View



Note If an interface is extremely busy, its LED will always be ON.

For more complete network troubleshooting information, refer to the *Troubleshooting Internetworking Systems* publication.

Note *Troubleshooting Internetworking Systems* is available on UniverCD or a printed copy can be ordered separately.

Enabling Booting from Flash Memory

To enable booting from Flash memory, set configuration register bits 3, 2, 1, and 0 to a value between 2 and 15 in conjunction with the **boot system flash** *[filename*] configuration command.

To enter the configuration mode, while in the system software image specify a Flash filename from which to boot, enter the **configure terminal** command at the enable prompt, as in the example following:

```
router# configure terminal
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
boot system flash [filename]
```

To disable break and enable the **boot system flash** command, enter the **config-register** command with the value shown in the example following:

```
router# config term
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
config-reg 0x2102
^Z
router#
```

Copying to Flash Memory

Copying a new image to Flash memory might be required whenever a new image or maintenance release becomes available. To copy a new image into Flash memory (write to Flash memory), you *must* first reboot from ROM and *then* copy the new image into Flash memory. You *cannot* copy a new image into Flash memory while the system is running from Flash memory. Use the **copy tftp flash** command for the copy procedure.

Following is a sample output for setting the configuration register to 0x2101, which tells the system to boot from ROM, but does *not* reset the break disable or check for a default netboot filename.

```
router# configure terminal
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
config-reg 0x2101
^Z
```

Following is sample output for reloading the router and then copying a file (called *IJ09140Z*) to Flash memory from a TFTP server (called *server1*):

```
router# reload
...
router(boot)# copy tftp flash
File  Length   Name/status
  1   4035664 IJ09140Y
[4035728 bytes used, 158576 available, 4194304 total]
Address or name of remote host [255.255.255.255]? server1
Source file name? IJ09140Z
Destination file name [default = source name]? <Return>
Accessing file 'IJ09140Z' on 131.108.1.111...
Loading IJ09140Z from 131.108.1.111 (via Ethernet0): !
Erase flash device before writing? [confirm]y
Flash contains files. Are you sure? [confirm]y
Copy 'IJ09140Z' from TFTP server
as 'IJ09140Z' into Flash WITH erase? [yes/no] y
Erasing device...  ... erased
Loading IJ09140Z from 131.108.1.111 (via Ethernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

Following is a sample output for setting the configuration register to 0x2102, which tells the system to boot from ROM if netboot fails, disable break, and check for a default netboot filename.

```
router(boot)# config term
Enter configuration commands, one per line.
Edit with DELETE, CTRL/W, and CTRL/U; end with CTRL/Z
config-reg 0x2102
^Z
```

After copying the file (called *IJ09140Z*) to Flash memory from a TFTP server (called *server1*), the router is reloaded, as follows:

```
router(boot)# reload
...
```

The system is now ready to be configured to boot from the new image you copied to Flash memory. For more information on the **copy tftp flash** command, and other related commands, refer to the router products configuration publication

Note The router products configuration publication is available on UniverCD or a printed copy can be ordered separately.

Cable Pinouts

The following tables list the pinouts for the cables that can be used with the 2500 series products:

- Console asynchronous serial port an adapter, Table 3-1
- Auxiliary asynchronous serial port and adapter, Table 3-2
- RJ-45 Straight and Rolled Cables, Table 3-3
- Pins for the RJ-45, M/F DTE, MF DCE, and MMOD, Table 3-4
- Connection Configuration, Table 3-5
- BRI, Table 3-6
- EIA-530 DTE synchronous serial, Table 3-7

- EIA/TIA-232 DTE and DCE synchronous serial, Table 3-8
- EIA/TIA-449 DTE and DCE synchronous serial, Table 3-9
- V.35 DTE and DCE synchronous serial, Table 3-10
- X.21 DTE and DCE synchronous serial, Table 3-11
- Ethernet AUI, Table 3-12
- Ethernet 10BaseT (RJ-45), Table 3-13
- Token Ring, Table 3-14
- Asynchronous serial (RJ-45), Table 3-15
- Asynchronous-Line Cable (68-Pin SCSI), Table 3-16

Table 3-1 Console Port Pinouts (RJ-45)

Pin[1]	Signal	Input/Output
1	–	–
2	DTR	Output
3	TXD	Output
4	GND	–
5	GND	–
6	RXD	Input
7	CD	Input
8	–	–

1. Any pin not referenced is not connected.

Table 3-2 Auxiliary Port Pinouts (RJ-45)

Pin[1]	Signal	Input/Output
1	RTS	Output
2	DTR	Output
3	TXD	Output
4	GND	–
5	GND	–
6	RXD	Input
7	CD	Input
8	CTS	Input

1. Any pin not referenced is not connected.

The connection of pins between the RJ-45 connector and the end device depends on the type of cable and adapter used. Either a straight or rolled cable can be used. Refer to Table 3-3 for the pinout of a straight and a rolled cable. The Cisco 2500 series products now ship with a rolled cable. Refer to Table 3-4 for a list of the pins used on the RJ-45 connector, the male/female DTE (MDTE/FDTE) adapter, the male/female DCE (MDTE/FDTE) adapter, and the male modem (MMOD) adapter used to connect terminals and modems to Cisco 2500 series products. Refer to Table 3-5 for the cable and adapter configurations that can be used to connect terminals and modems to Cisco 2500 series products.

Table 3-3 RJ-45 Straight and Rolled Cables

RJ-45 Pins	Straight Cable Pinout	Rolled Cable Pinout
1	1	8
2	2	7
3	3	6
4	4	5
5	5	4
6	6	3
7	7	2
8	8	1

Table 3-4 Pins for the RJ-45, MDTE/FDTE, MDCE/FDCE, and MMOD

Cable	DB-25 Adapters		
RJ-45 Pins	MDTE/FDTE Pins[1]	MDCE/FDCE Pins	MMOD Pins[2]
1	4	5	5
2	20	6	8
3	2	3	3
4	7	7	7
5	7	7	7
6	3	2	2
7	6	20	20
8	5	4	4

1. The FDTE adapter that is available through Cisco is labeled “Terminal.”
2. The MMOD adapter that is available through Cisco is labeled “Modem.”

Table 3-5 Connection Configuration

Cisco 2500 Port	RJ-45 Cable Type	DB-25 Adapter	End Device
Console	Rolled	MDTE/FDTE	Terminal
Console	Straight	MDCE/FDCE	Terminal
Console[1]	Rolled	MMOD	Modem
Aux	Rolled	MDTE/FDTE	Terminal
Aux	Straight	MDCE/FDCE	Terminal
Aux	Rolled	MMOD	Modem

1. Connecting a modem to the console port is not recommended. The console port does not have modem or flow control.

Figure 3-2 RJ-45-to-DB-9 Adapter Pinouts

RJ-45 Pin	Signal	DB-9 Pin
1	RTS	7
2	DTR	4
3	TXD	3
4	GND	5
5	GND	5
6	RXD	2
7	DSR	6
8	CTS	8

Table 3-6 BRI Port Pinout (RJ-45)

8 Pin[1]	TE[2]	NT[3]	Polarity
3	Transmit	Receive	+
4	Receive	Transmit	+
5	Receive	Transmit	–
6	Transmit	Receive	–

1. Pins 1, 2, 7, and 8 are not used.
2. TE refers to terminal terminating layer 1 aspects of TE1, TA, and NT2 functional groups.
3. NT refers to network terminating layer 1 aspects of NT1 and NT2 functional groups.

Warning Network hazardous voltages are accessible in the BRI cable. If you detach the BRI cable, detach the end away from the router first to avoid possible electric shock. Network hazardous voltages are also accessible on the system card in the area of the BRI port (RJ-45 connector), even when power is turned OFF.

Note All serial cables have a DB-60 connector on the router end. The following pinouts represent only the router ends of the cables. Because of the small pins on the DB-60 connector, manufacturing and soldering these cables yourself might be very difficult and is not recommended. In the following tables, serial pinouts for DTE and DCE cables use arrows to indicate signal direction: —> indicates DTE to DCE, and <— indicates DCE to DTE.

Table 3-7 EIA-530 DTE Serial Cable Pinout (DB-25)

25 Pin[1]	Signal	Direction DTE DCE[2]	25 Pin	Signal	Direction DTE DCE
J2-1	Shield	–	J2-8	CF(A), DCD+	<—
–	–	–	J2-10	CF(B), DCD–	<—
J2-2	BA(A), TxD+	—>	J2-15	DB(A), TxC+	<—
J2-14	BA(B), TxD–	—>	J2-12	DB(B), TxC–	<—
J2-3	BB(A), RxD+	<—	J2-17	DD(A), RxC+	<—
J2-16	BB(B), RxD–	<—	J2-9	DD(B), RxC–	<—
J2-4	CA(A), RTS+	—>	J2-18	LL	—>
J2-19	CA(B), RTS–	—>	J2-7	Circuit GND	–
J2-5	CB(A), CTS+	<—	J2-20	CD(A), DTR+	—>
J2-13	CB(B), CTS–	<—	J2-23	CD(B), DTR–	—>
J2-6	CC(A), DSR+	<—	J2-24	DA(A), TxCE+	—>
J2-22	CC(B), DSR–	<—	J2-11	DA(B), TxCE–	—>

1. Any pin not referenced is not connected.
2. The EIA-530 interface cannot be operated in DCE mode. A DCE cable is not available for the EIA-530 interface.

Table 3-8 EIA/TIA-232 DTE and DCE Serial Cable Pinouts (DB-25)

25 Pin[1]	Signal	Direction DTE	Direction DCE	25 Pin	Signal	Direction DTE	Direction DCE
J2-1	Shield GND	_		J2-7	Circuit GND	–	
				Shield	–	–	
J2-2	TxD	—>		J2-8	DCD	<—	
Shield	–	–		Shield	–	–	
J2-3	RxD	<—		J2-15	TxC	<—	
Shield	–	–		Shield	–	–	
J2-4	RTS	—>		J2-17	RxC	<—	
Shield	–	–		Shield	–	–	
J2-5	CTS	<—		J2-18	LTST	—>	
Shield	–	–		Shield	–	–	
J2-6	DSR	<—		J2-20	DTR	—>	
Shield	–	–		Shield	–	–	
				J2-24	TxCE	—>	
				Shield	–	–	

1. Any pin not referenced is not connected.

Table 3-9 EIA/TIA-449 DTE and DCE Serial Cable Pinouts (DB-37)

37 Pin[1]	Signal	Direction DTE	Direction DCE	37 Pin	Signal	Direction DTE	Direction DCE
J2-1	Shield GND	–		J2-9	CS+	—>	
				J2-27	CS–	—>	
J2-4	SD+	<—		J2-10	LL	—>	
J2-22	SD–	<—		J2-37	SC	–	
J2-5	ST+	—>		J2-11	DM+	—>	
J2-23	ST–	—>		J2-29	DM–	—>	
J2-6	RD+	—>		J2-12	TR+	<—	
J2-24	RD–	—>		J2-30	TR–	<—	
J2-7	RS+	<—		J2-13	RR+	—>	
J2-25	RS–	<—		J2-31	RR–	—>	
J2-8	RT+	—>		J2-17	TT+	<—	
J2-26	RT–	—>		J2-35	TT–	<—	
				J2-19	SG	–	
				J2-20	RC	–	

1. Any pin not referenced is not connected.

Table 3-10 V.35 DTE and DCE Serial Cable Pinouts (Winchester-Type 34 Pin)

34 Pin[1]	Signal	Direction DTE	Direction DCE	34 Pin	Signal	Direction DTE	Direction DCE
J2-A	Frame GND	–		J2-H	DTR	—>	
				Shield	–	–	
J2-B	Circuit GND	–		J2-K	LT	—>	
Shield	–	–		Shield	–	–	
J2-C	RTS	—>		J2-P	SD+	—>	
Shield	–	–		J2-S	SD–	—>	
J2-D	CTS	<—		J2-R	RD+	<—	
Shield	–	–		J2-T	RD–	<—	
J2-E	DSR	<—		J2-U	SCTE+	—>	
Shield	–	–		J2-W	SCTE–	—>	
J2-F	RLSD	<—		J2-V	SCR+	<—	
Shield	–	–		J2-X	SCR–	<—	
				J2-Y	SCT+	<—	
				J2-AA	SCT–	<—	

1. Any pin not referenced is not connected.

Table 3-11 X.21 DTE and DCE Serial Cable Pinouts (DB-15)

15 Pin[1]	Signal	Direction DTE	Direction DCE
J2-1	Shield GND	–	
J2-2	Transmit+	—>	
J2-9	Transmit–	—>	
J2-3	Control+	—>	
J2-10	Control–	—>	
J2-4	Receive+	<—	
J2-11	Receive–	<—	
J2-5	Indication+	<—	
J2-12	Indication–	<—	
J2-6	Timing+	<—	
J2-13	Timing–	<—	
J2-8	Circuit GND	–	
Shield	–	–	

1. Any pin not referenced is not connected.

Table 3-12 Ethernet (AUI) Port Pinout (DB-15)

15 Pin	Ethernet Circuit	Signal
1	CI-S	Control In Circuit Shield
2	CI-A	Control In Circuit A
3	DO-A	Data Out Circuit A
4	DI-S	Data In Circuit Shield
5	DI-A	Data In Circuit A
6	VC	Voltage Common
7	CO-A	Control Out Circuit A (not connected)
8	CO-S	Control Out Circuit Shield (not connected)
9	CI-B	Control In Circuit B
10	DO-B	Data Out Circuit B
11	DO-S	Data Out Circuit Shield
12	DI-B	Data In Circuit B
13	VP	Voltage Plus
14	VS	Voltage Shield (L25 and M25)
15	CO-B	Control Out Circuit B (not connected)
Shell	PG	Protective Ground

Table 3-13 Ethernet 10BaseT Port Pinout (RJ-45)

Pin	Signal
1	TX+
2	TX–
3	RX+
4	–
5	–
6	RX–
7	–
8	–

Table 3-14 Token Ring Port Pinout (DB-9)

9 Pin[1]	Signal
1	Receive R1–
3	+5V[2]
5	Transmit O5–
6	Receive G6+
9	Transmit B9+

1. Pins 2, 4, 7, and 8 are ground.
2. 600 mA maximum.

Table 3-15 Asynchronous Breakout Cable Pinout (8-Pin RJ-45)

8-Pin RJ-45	Signal	Direction
1	CTS	<—
2	DSR/DCD	<—
3	RXD	<—
4	RXD/GND	-
5	TXD/GND	-
6	TXD	—>
7	DTR	—>
8	RTS	—>

Table 3-16 Asynchronous-Line Cable Pinout (68-Pin SCSI)

RJ-45 Plug	Pin	Signal	68-Pin SCSI (J1)
1	8	RTS	2
	7	DTR	36
	6	TXD	3
	5	TXD GND	37
	4	RXD GND	4
	3	RXD	38
	2	DSR	5
	1	CTS	39
2	8	RTS	6
	7	DTR	40
	6	TXD	7
	5	TXD GND	41
	4	RXD GND	8
	3	RXD	42
	2	DSR	9
	1	CTS	43
3	8	RTS	10
	7	DTR	44
	6	TXD	11
	5	TXD GND	45
	4	RXD GND	12
	3	RXD	46
	2	DSR	13
	1	CTS	47

RJ-45 Plug	Pin	Signal	68-Pin SCSI (J1)
4	8	RTS	14
	7	DTR	48
	6	TXD	15
	5	TXD GND	49
	4	RXD GND	16
	3	RXD	50
	2	DSR	17
	1	CTS	51
5	8	RTS	18
	7	DTR	52
	6	TXD	19
	5	TXD GND	53
	4	RXD GND	20
	3	RXD	54
	2	DSR	21
	1	CTS	55
6	8	RTS	22
	7	DTR	56
	6	TXD	23
	5	TXD GND	57
	4	RXD GND	24
	3	RXD	58
	2	DSR	25
	1	CTS	59

RJ-45 Plug	Pin	Signal	68-Pin SCSI (J1)
7	8	RTS	26
	7	DTR	60
	6	TXD	27
	5	TXD GND	61
	4	RXD GND	28
	3	RXD	62
	2	DSR	29
	1	CTS	63
8	8	RTS	30
	7	DTR	64
	6	TXD	31
	5	TXD GND	65
	4	RXD GND	32
	3	RXD	66
	2	DSR	33
	1	CTS	67

Figure 3-3 shows the DB-25 breakout cable with pinouts for the 68-pin SCSI port and the DB-25 port. Table 3-17 lists the pinouts for the DB-25 end, and Table 3-18 lists the pinouts for the 68-pin SCSI connector end.

Figure 3-3 Asynchronous Serial Interface Breakout Cable Assembly (68-Pin SCSI-to-DB-25)

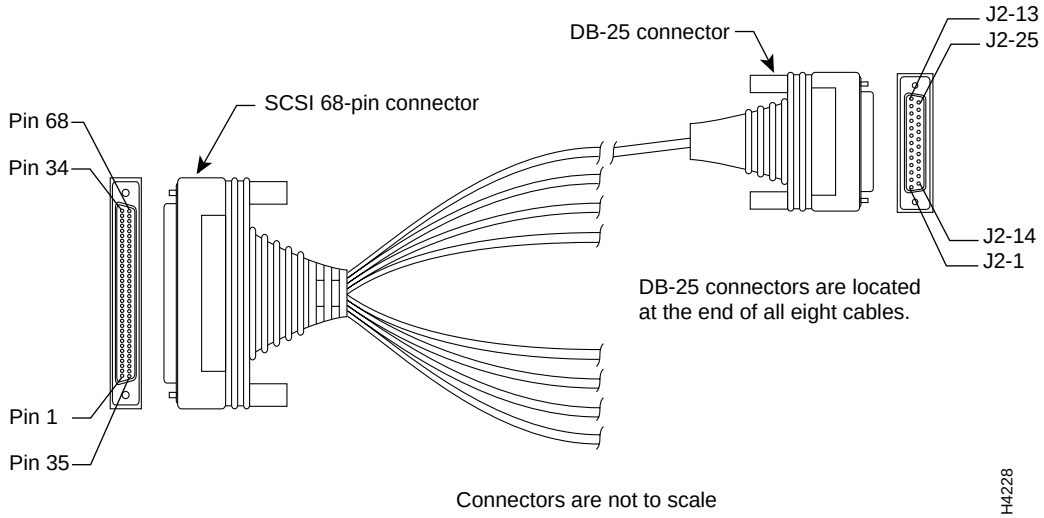


Table 3-17 Asynchronous Breakout Cable Pinouts (DB-25)

DB-25 Plug[1]	Signal	Direction
4	RTS	—>
20	DTR	—>
2	TXD	—>
7	TXD GND	—
7	RXD GND	—
3	RXD	<—
8	DSR	<—
5	CTS	<—

1. Any pin not referenced is not connected.

Table 3-18 Asynchronous Cable Pinouts (68-Pin SCSI-to-DB-25)

DB-25 Plug	Pin	Signal	68-Pin SCSI (J1)
1	4	RTS	2
	20	DTR	36
	2	TXD	3
	7	TXD GND	37
	7	RXD GND	4
	3	RXD	38
	8	DSR	5
	5	CTS	39

DB-25 Plug	Pin	Signal	68-Pin SCSI (J1)
2	4	RTS	6
	20	DTR	40
	2	TXD	7
	7	TXD GND	41
	7	RXD GND	8
	3	RXD	42
	8	DSR	9
	5	CTS	43
3	4	RTS	10
	20	DTR	44
	2	TXD	11
	7	TXD GND	45
	7	RXD GND	12
	3	RXD	46
	8	DSR	13
	5	CTS	47
4	4	RTS	14
	20	DTR	48
	2	TXD	15
	7	TXD GND	49
	7	RXD GND	16
	3	RXD	50
	8	DSR	17
	5	CTS	51

DB-25 Plug	Pin	Signal	68-Pin SCSI (J1)
5	4	RTS	18
	20	DTR	52
	2	TXD	19
	7	TXD GND	53
	7	RXD GND	20
	3	RXD	54
	8	DSR	21
	5	CTS	55
6	4	RTS	22
	20	DTR	56
	2	TXD	23
	7	TXD GND	57
	7	RXD GND	24
	3	RXD	58
	8	DSR	25
	5	CTS	59
7	4	RTS	26
	20	DTR	60
	2	TXD	27
	7	TXD GND	61
	7	RXD GND	28
	3	RXD	62
	8	DSR	29
	5	CTS	63

DB-25 Plug	Pin	Signal	68-Pin SCSI (J1)
8	4	RTS	30
	20	DTR	64
	2	TXD	31
	7	TXD GND	65
	7	RXD GND	32
	3	RXD	66
	8	DSR	33
	5	CTS	67

APPENDIX A

Regulatory Compliance

This appendix contains information for customers installing systems in the United Kingdom, Europe, and Italy. Refer to the section about your location.

Information for United Kingdom Use Only

Cisco Systems declaration of operating conditions:

The Cisco 2500 Series is designed to meet the requirements of NET1 and NET2.

Warnings

Interconnection directly, or by way of other apparatus, of ports marked:

"Safety Warning — See instructions for use"

with ports marked or not so marked may produce hazardous conditions on the network and that advice should be obtained from a competent engineer before such a connection is made.

The ports marked "Ethernet," "Token Ring," "Console," and "AUX" have a safety warning applied to them as follows:

"These ports do not provide isolation sufficient to satisfy the requirement of BS6301; apparatus connected to these ports should either have been approved to BS6301 or have previously been evaluated against British Telecommunications plc (Post Office) Technical Guides 2 or 26 and given permission to attach; any that other usage will invalidate any approval given to this apparatus."

This apparatus must be connected to a mains socket outlet with a protective earth contact.

Connection of Power Supply. The Gateway Server is intended for use when supplied with power from a supply providing 220-240 VAC, 50/60 Hz up to 5 Amps.

Other usage will invalidate any approval given to this apparatus if as a result it ceases to comply with BS6301: 1989.

The Cisco 2500 Series is brought into service by the supplier.

Information for European Community Use Only

The ports marked “Ethernet,” “Token Ring,” “Console,” and “AUX” are SELV circuits. SELV circuits should only be connected to other SELV circuits.

Information for Use in Italy Only

The following information applies to Cisco 2503 series and 2504 series models used within the country of Italy.

Warnings

AVVERTENZA PER GLI UTENTI DELLA CISCO 2503, 2504 PER CONNESSIONI ISDN ACCESSO BASICO

“Si raccomanda di spegnere il terminale quallora venisse spostato tra due prese dello stesso o di differente bus SO.”

WARNING FOR USERS OF THE CISCO 2503, 2504 FOR BASIC ACCESS ISDN CONNECTIONS

“It is recomended to switch off the terminal equipment when it is moved between two sockets of the same or different bus.”

APPENDIX B

System Specifications

Following are the specifications for the router system:

Table B-1 System Specifications

Description	Design Specification
Dimensions H x W x D	1.75"[1] x 17.5" x 10.56" (4.44 cm x 44.45 cm x 26.82 cm)
Weight	10 lb (4.5 kg)
Input voltage, frequency, and power dissipation	100 to 240 volts alternating current (VAC) at 50 to 60 hertz (Hz) 40W (max.) 135.5 British thermal units (Btus)/hr
Processor	20-MHz Motorola 68EC030
Memory	1-MB primary memory (DRAM SIMMs, expandable to 4 or 16 MB) 1-MB shared memory (DRAM on board) 1-MB boot ROM (expandable) 4-MB system code (PROM or Flash) (expandable) 32-KB nonvolatile configuration RAM
Router Network interface options	1 Ethernet and 2 synchronous serial (2501) 1 Token Ring and 2 synchronous serial (2502) 1 Ethernet, 2 synchronous serial, and 1 BRI (2503) 1 Token Ring, 2 synchronous serial, and 1 BRI (2504) 1 Ethernet, 1 Token Ring, 2 synchronous serial (2513) 2 Ethernet, 2 synchronous serial (2514) 2 Token Ring, 2 synchronous serial (2515)

Description	Design Specification
Hub Network interface options	1 Ethernet, 2 synchronous serial, 8 hub (2505) ~~1 Token Ring, 2 synchronous serial, 8 hub (2506)~~ 1 Ethernet, 2 synchronous serial, 16 hub (2507)~~1 Token Ring, 2 synchronous serial, 16 hub (2508)~~
Access Server Network interface options	1 Ethernet, 2 synchronous serial, 8 asynchronous serial (2509) 1 Token Ring, 2 synchronous serial, 8 asynchronous serial (2510) 1 Ethernet, 2 synchronous serial, 16 asynchronous serial (2511) 1 Token Ring, 2 synchronous serial, 16 asynchronous serial (2512)
Ethernet interface	Attachment unit interface (AUI) IEEE 802.3 (DB-15)
Token Ring interface	IEEE 802.5 (DB-9)
Synchronous serial interfaces	EIA/TIA-232[2], EIA/TIA-449, V.35, X.21 (NRZ/NRZI[3] and DTE/DCE[4]) EIA-530 (NRZ/NRZI and DTE) All serial cables use a DB-60 chassis connector.
Asynchronous serial interfaces	EIA/TIA-232, EIA/TIA-449, with hardware flow control support. Asynchronous serial interfaces use the breakout cable (RJ-45)
BRI	ISDN Basic Rate S/T (RJ-45) (2503 and 2504 only)
Console and auxiliary ports	Asynchronous serial (RJ-45)
Operating environment	32 to 104°F (0 to 40°C)
Nonoperating temperature	–40 to 185°F (–40 to 85°C)
Operating humidity	5 to 95%, noncondensing
Noise level	34 dBa @ 3' (0.914 m)

1. 1.75" = One rack unit.
2. EIA/TIA-232 and EIA/TIA-449 were known as recommended standards RS-232 and RS-449 before their acceptance as standards by the Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA).
3. NRZ = Nonreturn to zero. NRZI = Nonreturn to zero inverted.
4. DTE = Data terminal equipment. DCE = Data communications equipment.